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(71) [Applicant]
[Identification Number] 000002853
[Name] Daikin Industries, LTD.
[Address] 2-4-12, Nakazaki-nishi, Kita-ku, Osaka-shi, Osaka The Umeda pin center,large building

(72) [Inventor(s)]
[Name] Hirara Shigeji
[Address] 1000-2, Otani, Okamoto-cho, Kusatsu-shi, Shiga-ken Daikin Industries Shiga Manufacture Within a station
(74) [Attorney]
[Identification Number] 100062144
[Patent Attorney]
[Name] Aoyama ** (besides one person)

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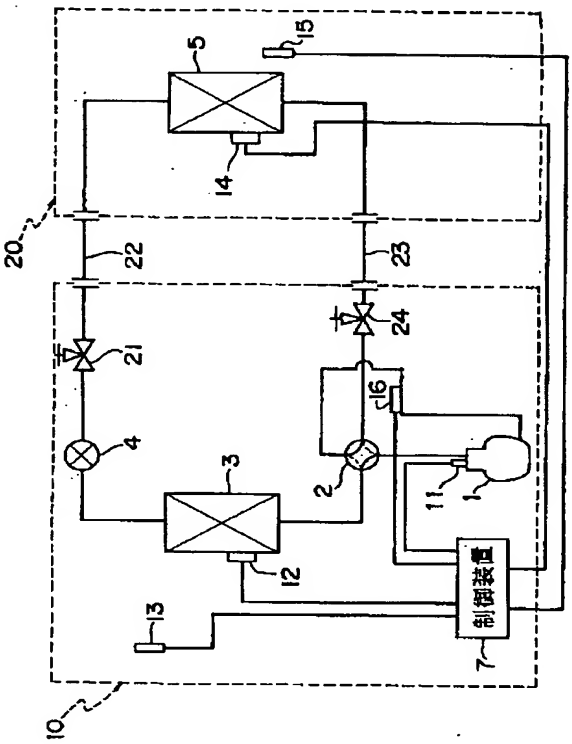
Epitome

(57) [Abstract]
[Technical problem] The freezer which can perform cost reduction and a miniaturization is offered using the actuation medium containing R32 refrigerant.
[Means for Solution] The refrigerating capacity using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more can lose an accumulator and a receiver with a freezer 4kW or less to the refrigerant circuit which has a compressor 1, an outdoor heat exchanger 3, the electric expansion valve 4, and indoor heat exchanger 5.

[Translation done.]



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CLAIMS

[Claim(s)]
[Claim 1] The freezer characterized by being a freezer using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more, and not having an accumulator in the above-mentioned refrigerant circuit in the refrigerant circuit where the compressor (1), the condenser (3), the reduced pressure means (4), and the evaporator (5) were connected annularly.
[Claim 2] The freezer characterized by being a freezer using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more, and not having a receiver in the above-mentioned refrigerant circuit in the refrigerant circuit where the compressor (1), the condenser (3), the reduced pressure means (4), and the evaporator (5) were connected annularly.

[Claim 3] The freezer characterized by being a freezer using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more, and not having an accumulator and a receiver in the above-mentioned refrigerant circuit in the refrigerant circuit where the compressor (1), the condenser (3), the reduced pressure means (4), and the evaporator (5) were connected annularly.
[Claim 4] The freezer characterized by refrigerating capacity being 4kW or less in claim 1 thru/or the freezer of any one publication of three.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the freezer using the actuation medium containing R32 (chemical formula CH2F 2) refrigerant.
[0002]
[Description of the Prior Art] In the freezer of a heat pump method using a refrigerant, since ozone depletion potential and a HCFC system refrigerant with large GWP (global warming potential) were set as the object of fluorine regulation, the R410A (R32:R125=50:50) refrigerant is used as the alternative refrigerant as a high HFC system refrigerant of GWP which does not destroy an ozone layer. In the freezer using this R410A refrigerant, that from which COP (coefficient of performance) equivalent to R22 is obtained is produced commercially. However, while a refrigerant fill must be made [many], and cost costs dearly since the big accumulator and big receiver of the volume are required in order to acquire capacity sufficient in this R410A refrigerant since heat delivery capacity is low, in order to have to take arrangement of an accumulator and a receiver into consideration, there is a problem that a miniaturization is easily impossible.
[0003] Then, the purpose of this invention is to offer the freezer which can perform cost

reduction and a miniaturiz[redacted]n using the actuation medium containing [redacted]2 refrigerant.
[0004]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the freezer of claim 1 is a freezer using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more in the refrigerant circuit where the compressor, the condenser, the reduced pressure means, and the evaporator were connected annularly, and is characterized by not having an accumulator in the above-mentioned refrigerant circuit.
[0005] In the freezer using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more, high COP was obtained by the refrigerant fill with few R32 refrigerants than an R410A refrigerant, and these people found out by experiment that the difference of the amount of optimal refrigerants at the time of air conditioning and the amount of optimal refrigerants at the time of heating is also still smaller.
[0006] According to the freezer of above-mentioned claim 1, therefore, the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more While heat conveyance capacity is high compared with an R410A refrigerant and sufficient capacity is acquired by the small refrigerant fill Since the difference of the amount of optimal refrigerants at the time of air conditioning and the amount of optimal refrigerants at the time of heating is small compared with an R410A refrigerant, even if there is no accumulator itself by capacity adjustment of the whole system, such as heat exchanger capacity, the amount of refrigerants can be adjusted. This becomes possible to lose an accumulator and cost reduction and a miniaturization can be performed. [(An accumulator means the product side accumulator of the low voltage receiver mold for refrigerant adjustment instead of AKYUMU attached to a compressor here.) 0007] Moreover, the freezer of claim 2 is a freezer using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more in the refrigerant circuit where the compressor, the condenser, the reduced pressure means, and the evaporator were connected annularly, and is characterized by not having a receiver in the above-mentioned refrigerant circuit.
[0008] According to the freezer of above-mentioned claim 2, the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more While heat conveyance capacity is high compared with an R410A refrigerant and sufficient capacity is acquired by the small refrigerant fill Since the difference of the amount of optimal refrigerants at the time of air conditioning and the amount of optimal refrigerants at the time of heating is small compared with an R410A refrigerant, even if there is no receiver itself by capacity adjustment of the whole system, such as heat-exchanger capacity, the amount of refrigerants can be adjusted. This becomes possible to lose a receiver and cost reduction and a miniaturization can be performed.
[0009] Moreover, the freezer of claim 3 is a freezer using the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more in the refrigerant circuit where the compressor, the condenser, the reduced pressure means, and the evaporator were connected annularly, and is characterized by not having an accumulator and a receiver in the above-mentioned refrigerant circuit.
[0010] According to the freezer of above-mentioned claim 3, the mixed refrigerant which contains R32 refrigerant or R32 at least 70% of the weight or more While heat conveyance capacity is high compared with an R410A refrigerant and sufficient capacity is acquired by the small refrigerant fill Since the difference of the amount of optimal refrigerants at the time of air conditioning and the amount of optimal refrigerants at the time of heating is small compared with an R410A refrigerant, even if there are not an accumulator and the receiver itself by capacity adjustment of the whole system, such as heat-exchanger capacity, the amount of refrigerants can be adjusted. This becomes possible to lose an accumulator and a receiver, and cost reduction and a miniaturization can be performed.
[0011] Moreover, the freezer of claim 4 is characterized by refrigerating capacity being 4kW or less in claim 1 thru/or any one freezer of 3.
[0012] If refrigerating capacity is 4kW or less according to the freezer of above-mentioned claim 4, an accumulator and a receiver (the modulator for accommodation of the air conditioning/heating in an air conditioner is also included) can be lost certainly.

[0013]
[Embodiment of the Invention] Hereafter, the gestalt of implementation of illustration explains the freezer of this invention to a detail.
[0014] Drawing 1 is the circuit diagram showing the outline configuration of the heat pump type air conditioner as a freezer of one gestalt of implementation of this invention. The 4 way change-over valve to which, as for 1, the compressor was connected to the discharge side of the above-mentioned compressor 1, and, as for 2, the end was connected, The outdoor heat exchanger by which, as for 3, the end was connected to the other end of the above-mentioned 4 way change-over valve 2, the electric expansion valve by which, as for 4, the end was connected to the other end of the above-mentioned outdoor heat exchanger 3, and 5 are the indoor heat exchangers by which the end was connected to the other end of the above-mentioned electric expansion valve 4, and the other end was connected to the inlet side of a compressor 1 through the 4 way change-over valve 2. The temperature sensor 11 with which the above-mentioned air conditioner detects the discharge-tube temperature of a compressor 1, The temperature sensor 12 which detects the coolant temperature of an outdoor heat exchanger 3, and the temperature sensor 13 which detects an OAT, The temperature sensor 14 which detects the coolant temperature of indoor heat exchanger 5, and the temperature sensor 15 which detects whenever [room air temperature], It has the temperature sensor 16 which detects the coolant temperature by the side of intake of the above-mentioned compressor 1, and the control unit 7 which controls a compressor 1 and electric expansion valve 4 grade in response to the signal from the above-mentioned temperature sensors 11-16. Moreover, while arranging the closing valve 21 between the above-mentioned electric expansion valve 4 and indoor heat exchanger 5, the closing valve 24 is arranged between indoor heat exchanger 5 and the 4 way change-over valve 2.
[0015] While constituting an outdoor unit 10 from the above-mentioned compressor 1, the 4 way change-over valve 2, an outdoor heat exchanger 3, the electric expansion valve 4, a control unit 7, the closing valve 21, the closing valve 24, temperature sensors 11-13, a temperature sensor 16, and an outdoor fan (not shown), the indoor unit 20 consists of indoor heat exchanger 5, a temperature sensor 14, a temperature sensor 15, and an indoor fan (not shown).
[0016] In the air conditioner of the above-mentioned configuration, the actuation medium which consists of R32 refrigerant and refrigerating machine oil is used. And if the 4 way change-over valve 2 is switched to the change location of a continuous line and a compressor 1 is started at the time of air conditioning operation, the high-pressure refrigerant breathed out from the compressor 1 will go into an outdoor heat exchanger 3 through the 4 way change-over valve 2. And after the refrigerant condensed by the above-mentioned outdoor heat exchanger 3 is decompressed by the electric expansion valve 4, it goes into indoor heat exchanger 5 through interunit piping 22. The refrigerant which evaporated in the above-mentioned indoor heat exchanger 5 returns to the inlet side of a compressor 1 through interunit piping 23 and the 4 way change-over valve 2. In this way, the actuation medium containing R32 refrigerant circulates through the refrigerant circuit which consisted of the above-mentioned compressor 1, an outdoor heat exchanger 3, an electric expansion valve 4, and indoor heat exchanger 5, and a refrigerating cycle is performed. And the interior of a room is air-conditioned by circulating indoor air through indoor heat exchanger 5 by the indoor fan (not shown).
[0017] These people investigated COP to a refrigerant fill by experiment about R410A and R32 refrigerant. This experiment was conducted on the air conditioning standard conditions and heating standard conditions based on JISC9612. Drawing 2 shows the result of the experiment, in drawing 2 , an axis of abscissa is a refrigerant fill and an axis of ordinate is a COP ratio (ratio of COP of R32 to COP of R410A). As shown in drawing 2 , the amounts of optimal refrigerants from which it is at the air conditioning and heating time, and COP serves as max in an R410A refrigerant differ, and there are few refrigerant fills at the time of heating. On the other hand, in R32 refrigerant, the amounts of optimal refrigerants from which it is at the air conditioning and heating time, and COP serves as max differed, while there were few refrigerant fills at the time of heating, there were few any amounts of optimal refrigerants than an R410A refrigerant, and COP became high. Furthermore, R32 refrigerant was understood that the difference of the

amount of optimal refrige[redacted]s from which it is at the air conditioning and heating time, and COP serves as max is smaller than an R410A refrigerant.
[0018] Moreover, in R410A, R22, and R32 refrigerant, the experiment investigated the minimum volume required for the accumulator and receiver to refrigerating capacity of an air conditioner. Since the required refrigerant fill decreased so that refrigerating capacity became small as a result of the experiment, as shown in drawing 3 , although, as for the volume of an accumulator and a receiver, all of R410A, R22, and R32 refrigerant became small, as for the volume of an accumulator and a receiver, R32 refrigerant became small rather than R410A and R22 refrigerant. And refrigerating capacity is needed in the air conditioner using R32 refrigerant, an accumulator and a receiver are usually needed for the air conditioner of smallness - a medium size in 4kW or more so that clearly from drawing 3 , but by capacity adjustment of the whole system, such as heat-exchanger capacity, even if it does not have an accumulator and the receiver itself, the amount adjustment of refrigerants may be enabled. That is, an air conditioner can be made the configuration of an accumulator and receiver loess as much as possible.
[0019] Therefore, according to the above-mentioned air conditioner, it becomes possible using R32 refrigerant to lose an accumulator and a receiver, and cost reduction and a miniaturization can plan.
[0020] Moreover, if refrigerating capacity is 4kW or less, an accumulator and a receiver can be lost certainly.
[0021] With the gestalt of the above-mentioned implementation, although the air conditioner was explained as a freezer, this invention may be applied to other freezers.
[0022] Moreover, although the gestalt of the above-mentioned implementation explained the air conditioner which used R32 refrigerant as a freezer, the mixed refrigerant which contains not only this but R32 at least 70% of the weight or more is sufficient as the refrigerant used for a freezer. For example, it is the mixed refrigerant of R32 refrigerant and CO2, and 70 % of the weight or more and 90% of the weight or less of a mixed refrigerant is [R32 refrigerant may also stop 70 % of the weight or more and 90% of the weight or less of a mixed refrigerant to CO2, and / it may be the mixed refrigerant of R32 refrigerant and R22 refrigerant, and] sufficient as R32 refrigerant to R22 refrigerant.
[0023]
[Effect of the Invention] As mentioned above, by using the mixed refrigerant with which heat conveyance capacity contains R32 [high] refrigerant or R32 at least 70% of the weight or more according to the freezer of this invention so that clearly Since there are few differences of the amount of optimal refrigerants at the time of air conditioning and the amount of optimal refrigerants at the time of heating compared with an R410A refrigerant while sufficient capacity is acquired by the small refrigerant fill compared with an R410A refrigerant, an accumulator and a receiver can be lost and cost reduction and a miniaturization can be attained. Moreover, since a refrigerant fill can be reduced and the value of direct global warming can also be reduced, there is a merit which can offer easily the freezer in which the earth environment correspondence by the reduction in GWP and energy saving of R32 is possible.
[0024] Moreover, when refrigerating capacity makes it 4kW or less, an accumulator and a receiver can be lost certainly.

[Translation done.]

3.In the drawings, any words are not translated.

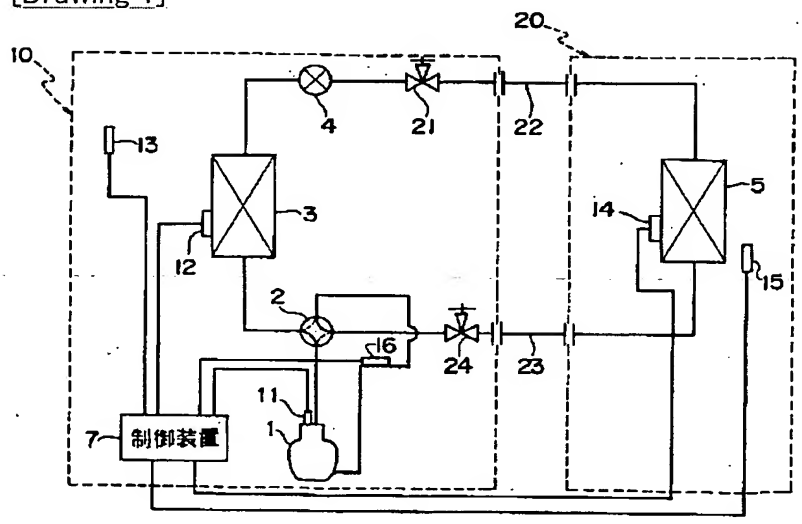
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is the circuit diagram showing the outline configuration of the air conditioner as a freezer of one gestalt of implementation of this invention.
[Drawing 2] Drawing 2 is drawing showing COP to the refrigerant fill at the time of the air conditioning about an R410A refrigerant and R32 refrigerant, and heating.
[Drawing 3] Drawing 3 is drawing showing the volume of an accumulator and a receiver to the refrigerating capacity of R410A and R22 refrigerant and R32 refrigerant.
[Description of Notations]
1 [-- An electric expansion valve, 5 / -- An outdoor heat exchanger, 7 / -- A control unit, 10 / -- An outdoor unit, 20 / -- Indoor unit.] -- A compressor, 2 -- A 4 way change-over valve, 3 -- An outdoor heat exchanger, 4

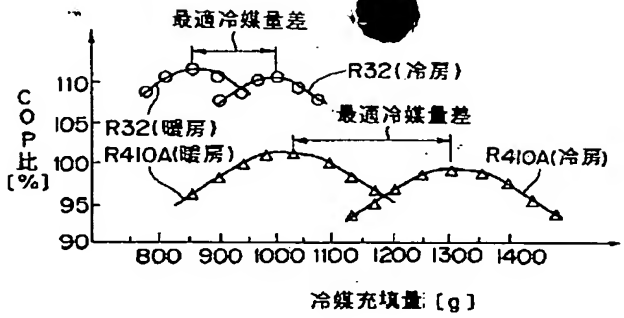
[Translation done.]

DRAWINGS

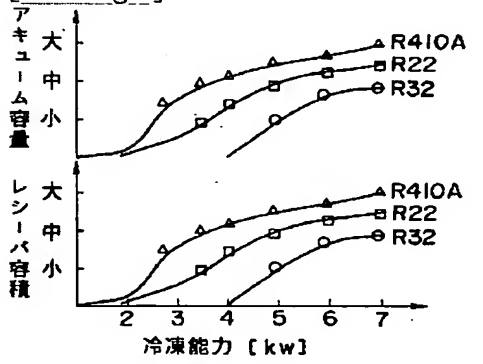
[Drawing 1]



[Drawing 2]



[Drawing 3]



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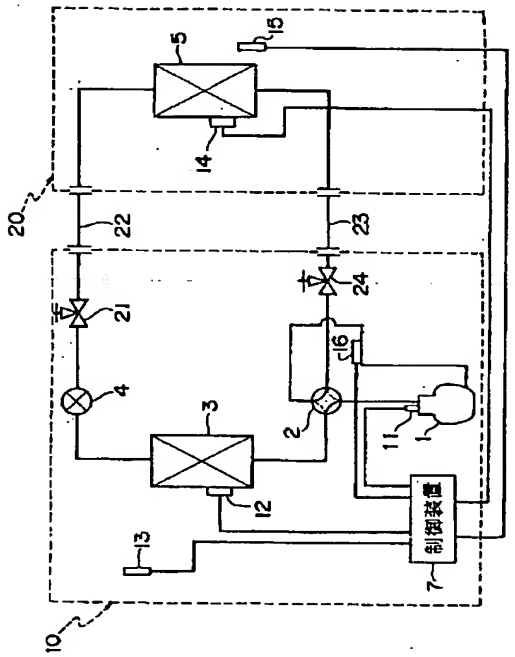
(71)出願人　000002853
ダイキン工業株式会社
大阪府大阪市北区中崎西２丁目４番12号
梅田センタービル
(72)発明者　平良　繁治
滋賀県草津市岡本町字大谷1000番地の２
ダイキン工業株式会社滋賀製作所内
(74)代理人　100062144
弁理士　青山　葆　（外１名）

(54)【発明の名称】　冷凍装置

(57)【要約】
【課題】　Ｒ３２冷媒を含む作動媒体を用いて、コスト低減と小型化ができる冷凍装置を提供する。
【解決手段】　圧縮機１,室外熱交換器３,電動膨張弁４および室内熱交換器５を有する冷媒回路に、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いた冷凍能力が４ｋＷ以下の冷凍装置では、アキュームレータやレシーバを無くすことができる。



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【特許請求の範囲】

【請求項１】　圧縮機(１),凝縮器(３),減圧手段(４)および蒸発器(５)が環状に接続された冷媒回路に、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いた冷凍装置であって、上記冷媒回路にアキュームレータを有しないことを特徴とする冷凍装置。

【請求項２】　圧縮機(１),凝縮器(３),減圧手段(４)および蒸発器(５)が環状に接続された冷媒回路に、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いた冷凍装置であって、上記冷媒回路にレシーバを有しないことを特徴とする冷凍装置。

【請求項３】　圧縮機(１),凝縮器(３),減圧手段(４)および蒸発器(５)が環状に接続された冷媒回路に、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いた冷凍装置であって、上記冷媒回路にアキュームレータおよびレシーバを有しないことを特徴とする冷凍装置。

【請求項４】　請求項１乃至３のいずれか１つに記載の冷凍装置において、冷凍能力が４ｋW以下であることを特徴とする冷凍装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、Ｒ３２(化学式CH_2F_2)冷媒を含む作動媒体を用いた冷凍装置に関する。

【０００２】

【従来の技術および発明が解決しようとする課題】冷媒を用いたヒートポンプ方式の冷凍装置において、オゾン層破壊係数やＧＷＰ(地球温暖化係数)が大きいＨＣＦＣ系冷媒がフロン規制の対象となったことから、その代替冷媒として、オゾン層を破壊しないＧＷＰの高いＨＦＣ系冷媒としてＲ４１０Ａ(Ｒ３２：Ｒ１２５＝５０：５０)冷媒が用いられている。このＲ４１０Ａ冷媒を用いた冷凍装置では、Ｒ２２と同等のＣＯＰ(成績係数)が得られるものが製品化されている。ところが、このＲ４１０Ａ冷媒では、熱運搬能力が低いために十分な能力を得るために冷媒充填量を多くしなければならず、容積の大きなアキュームレータおよびレシーバが必要なため、コストが高くつくと共に、アキュームレータやレシーバの配置を考慮しなければならないため、小型化が容易にできないという問題がある。

【０００３】そこで、この発明の目的は、Ｒ３２冷媒を含む作動媒体を用いて、コスト低減と小型化ができる冷凍装置を提供することにある。

【０００４】

【課題を解決するための手段】上記目的を達成するため、請求項１の冷凍装置は、圧縮機,凝縮器,減圧手段および蒸発器が環状に接続された冷媒回路に、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いた冷凍装置であって、上記冷媒回路にアキュームレータを有しないことを特徴としている。

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【０００５】本出願人は、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いた冷凍装置において、Ｒ３２冷媒がＲ４１０Ａ冷媒よりも少ない冷媒充填量で高いＣＯＰが得られ、さらに、冷房時の最適冷媒量と暖房時の最適冷媒量との差も小さいということを実験により見出した。

【０００６】したがって、上記請求項１の冷凍装置によれば、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒は、Ｒ４１０Ａ冷媒に比べて熱搬送能力が高く、少ない冷媒充填量で十分な能力が得られると共に、Ｒ４１０Ａ冷媒に比べて冷房時の最適冷媒量と暖房時の最適冷媒量との差が小さいので、熱交換器容量等のシステム全体の容量調整によりアキュームレータ自体がなくとも冷媒量を調整できる。これにより、アキュームレータを無くすことが可能となり、コスト低減と小型化ができる。(ここに、アキュームレータとは、圧縮機に付属しているアキュームではなく、冷媒調整用の低圧レシーバ型の製品側アキュームレータを言う。)

【０００７】また、請求項２の冷凍装置は、圧縮機,凝縮器,減圧手段および蒸発器が環状に接続された冷媒回路に、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いた冷凍装置であって、上記冷媒回路にレシーバを有しないことを特徴としている。

【０００８】上記請求項２の冷凍装置によれば、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒は、Ｒ４１０Ａ冷媒に比べて熱搬送能力が高く、少ない冷媒充填量で十分な能力が得られると共に、Ｒ４１０Ａ冷媒に比べて冷房時の最適冷媒量と暖房時の最適冷媒量との差が小さいので、熱交換器容量等のシステム全体の容量調整によりレシーバ自体がなくとも冷媒量を調整できる。これにより、レシーバを無くすことが可能となり、コスト低減と小型化ができる。

【０００９】また、請求項３の冷凍装置は、圧縮機,凝縮器,減圧手段および蒸発器が環状に接続された冷媒回路に、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いた冷凍装置であって、上記冷媒回路にアキュームレータおよびレシーバを有しないことを特徴としている。

【００１０】上記請求項３の冷凍装置によれば、Ｒ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒は、Ｒ４１０Ａ冷媒に比べて熱搬送能力が高く、少ない冷媒充填量で十分な能力が得られると共に、Ｒ４１０Ａ冷媒に比べて冷房時の最適冷媒量と暖房時の最適冷媒量との差が小さいので、熱交換器容量等のシステム全体の容量調整によりアキュームレータおよびレシーバ自体がなくとも冷媒量を調整できる。これにより、アキュームレータおよびレシーバを無くすことが可能となり、コスト低減と小型化ができる。

【００１１】また、請求項４の冷凍装置は、請求項１乃

至３のいずれか１つの冷凍装置において、冷凍能力が４ｋＷ以下であることを特徴としている。

【００１２】上記請求項４の冷凍装置によれば、冷凍能力が４ｋＷ以下であれば、確実にアキュームレータおよびレシーバ(空気調和機における冷房／暖房の調節用のモジュレータも含む)を無くすことができる。

【００１３】

【発明の実施の形態】以下、この発明の冷凍装置を図示の実施の形態により詳細に説明する。

【００１４】図１はこの発明の実施の一形態の冷凍装置としてのヒートポンプ式空気調和機の概略構成を示す回路図であり、１は圧縮機、２は上記圧縮機１の吐出側に一端が接続された四路切換弁、３は上記四路切換弁２の他端に一端が接続された室外熱交換器、４は上記室外熱交換器３の他端に一端が接続された電動膨張弁、５は上記電動膨張弁４の他端に一端が接続され、他端が四路切換弁２を介して圧縮機１の吸入側に接続された室内熱交換器である。上記空気調和機は、圧縮機１の吐出管温度を検出する温度センサ１１と、室外熱交換器３の冷媒温度を検出する温度センサ１２と、外気温度を検出する温度センサ１３と、室内熱交換器５の冷媒温度を検出する温度センサ１４と、室内温度を検出する温度センサ１５と、上記圧縮機１の吸込側の冷媒温度を検出する温度センサ１６と、上記温度センサ１１～１６からの信号を受けて、圧縮機１,電動膨張弁４等を制御する制御装置７とを備えている。また、上記電動膨張弁４と室内熱交換器５との間に閉鎖弁２１を配設すると共に、室内熱交換器５と四路切換弁２との間に閉鎖弁２４を配設している。

【００１５】上記圧縮機１,四路切換弁２,室外熱交換器３,電動膨張弁４,制御装置７,閉鎖弁２１,閉鎖弁２４,温度センサ１１～１３,温度センサ１６および室外ファン(図示せず)で室外ユニット１０を構成すると共に、室内熱交換器５,温度センサ１４,温度センサ１５および室内ファン(図示せず)で室内ユニット２０を構成している。

【００１６】上記構成の空気調和機では、Ｒ３２冷媒と冷凍機油とからなる作動媒体を用いている。そして、冷房運転時、四路切換弁２を実線の切換え位置に切り換えて、圧縮機１を起動すると、圧縮機１から吐出された高圧冷媒が四路切換弁２を通って室外熱交換器３に入る。そして、上記室外熱交換器３で凝縮した冷媒が電動膨張弁４で減圧された後、連絡配管２２を通って室内熱交換器５に入る。上記室内熱交換器５で蒸発した冷媒が連絡配管２３,四路切換弁２を介して圧縮機１の吸入側に戻る。こうして、上記圧縮機１,室外熱交換器３,電動膨張弁４および室内熱交換器５で構成された冷媒回路をＲ３２冷媒を含む作動媒体が循環して、冷凍サイクルを実行する。そして、室内ファン(図示せず)により室内熱交換器５を介して室内空気を循環させることにより室内を冷房する。

【００１７】本出願人は、Ｒ４１０Ａ,Ｒ３２冷媒について冷媒充填量に対するＣＯＰを実験により調べた。この実験は、ＪＩＳＣ９６１２に準拠した冷房標準条件および暖房標準条件で行った。図２はその実験の結果を示しており、図２において、横軸が冷媒充填量であり、縦軸がＣＯＰ比(Ｒ４１０ＡのＣＯＰに対するＲ３２のＣＯＰの比率)である。図２に示すように、Ｒ４１０Ａ冷媒では、冷房時と暖房時でＣＯＰが最大となる最適冷媒量が異なり、暖房時の冷媒充填量が少ない。一方、Ｒ３２冷媒では、冷房時と暖房時でＣＯＰが最大となる最適冷媒量が異なり、暖房時の冷媒充填量が少ないと共に、いずれの最適冷媒量もＲ４１０Ａ冷媒より少なく、かつＣＯＰが高くなった。さらに、Ｒ３２冷媒は、冷房時と暖房時でＣＯＰが最大となる最適冷媒量の差がＲ４１０Ａ冷媒よりも小さいことが分かった。

【００１８】また、Ｒ４１０Ａ,Ｒ２２およびＲ３２冷媒において空気調和機の冷凍能力に対するアキュームレータおよびレシーバに必要な最小容積を実験により調べた。その実験の結果、図３に示すように、冷凍能力が小さくなるほど、必要な冷媒充填量が少なくなるので、Ｒ４１０Ａ,Ｒ２２およびＲ３２冷媒のいずれもアキュームレータおよびレシーバの容積は小さくなるが、Ｒ４１０Ａ,Ｒ２２冷媒よりもＲ３２冷媒の方がアキュームレータおよびレシーバの容積は小さくなった。そして、図３から明らかなように、Ｒ３２冷媒を用いた空気調和機では、冷凍能力が４ｋＷ以上では、通常は小～中型の空気調和機にアキュームレータおよびレシーバが要るが、熱交換器容量等のシステム全体の容量調整により、アキュームレータおよびレシーバ自体を備えなくても、冷媒量調整を可能にでき得る。つまり、空気調和機を可及的にアキュームレータ,レシーバレスの構成にすることができる。

【００１９】したがって、上記空気調和機によれば、Ｒ３２冷媒を用いて、アキュームレータおよびレシーバを無くすことが可能となり、コスト低減と小型化が図ることができる。

【００２０】また、冷凍能力が４ｋＷ以下であれば、確実にアキュームレータおよびレシーバを無くすことができる。

【００２１】上記実施の形態では、冷凍装置として空気調和機について説明したが、他の冷凍装置にこの発明を適用してもよい。

【００２２】また、上記実施の形態では、冷凍装置としてＲ３２冷媒を用いた空気調和機について説明したが、冷凍装置に用いられる冷媒はこれに限らず、Ｒ３２を少なくとも７０重量%以上含む混合冷媒でもよい。例えば、Ｒ３２冷媒とCO_2との混合冷媒であって、CO_2に対してＲ３２冷媒が７０重量%以上かつ９０重量%以下の混合冷媒でもよし、Ｒ３２冷媒とＲ２２冷媒との混合

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冷媒であって、Ｒ２２冷媒に対してＲ３２冷媒が７０重量%以上かつ９０重量%以下の混合冷媒でもよい。

【００２３】

【発明の効果】以上より明らかなように、この発明の冷凍装置によれば、熱搬送能力が高いＲ３２冷媒またはＲ３２を少なくとも７０重量%以上含む混合冷媒を用いることによって、Ｒ４１０Ａ冷媒に比べて少ない冷媒充填量で十分な能力が得られると共に、Ｒ４１０Ａ冷媒に比べて冷房時の最適冷媒量と暖房時の最適冷媒量との差が少ないので、アキュームレータやレシーバを無くすことができ、コスト低減と小型化を図ることができる。また、冷媒充填量を低減できるため、直接的な地球温暖化の値も低減できるため、Ｒ３２の低ＧＷＰ化および省エネルギー化による地球環境対応が可能な冷凍装置を容易に提供できるメリットがある。

【００２４】また、冷凍能力が４ｋＷ以下にすることに＊

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＊よって、確実にアキュームレータやレシーバを無くすことができる。

【図面の簡単な説明】

【図１】　図１はこの発明の実施の一形態の冷凍装置としての空気調和機の概略構成を示す回路図である。

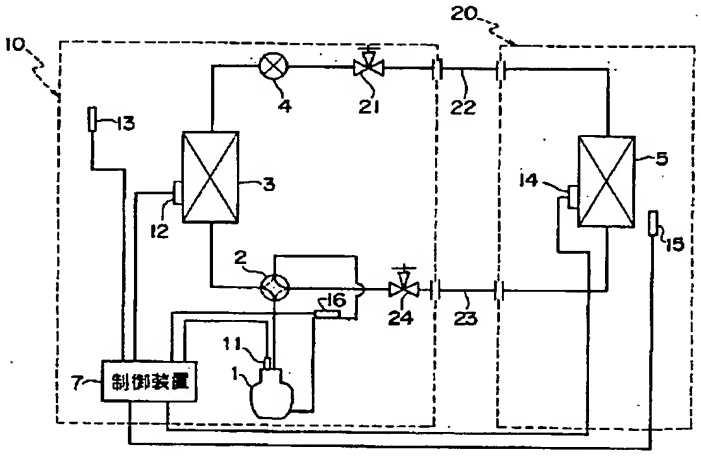
【図２】　図２はＲ４１０Ａ冷媒とＲ３２冷媒についての冷房時と暖房時の冷媒充填量に対するＣＯＰを示す図である。

【図３】　図３はＲ４１０Ａ,Ｒ２２冷媒とＲ３２冷媒の冷凍能力に対するアキュームレータおよびレシーバの容積を示す図である。

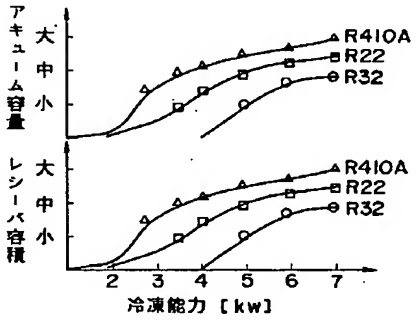
【符号の説明】

１…圧縮機、２…四路切換弁、３…室外熱交換器、４…電動膨張弁、５…室外熱交換器、７…制御装置、１０…室外ユニット、２０…室内ユニット。

【図１】



【図３】



【図２】